

Oil and Gas Development in Lubbock

How changes to the Lubbock Drilling Ordinance can impact YOU



August 2013



The History of Oil and Gas Development in Lubbock

Texas would have been the 11th largest oil producing nation in the world.

Texas has been home to oil and gas exploration since January 10, 1901, when oil was found at Spindletop Hill near Beaumont. Since that time, Texas has been a world leader in oil production—in fact, based on production last April, Texas would have been the 11th largest oil producing nation in the world.

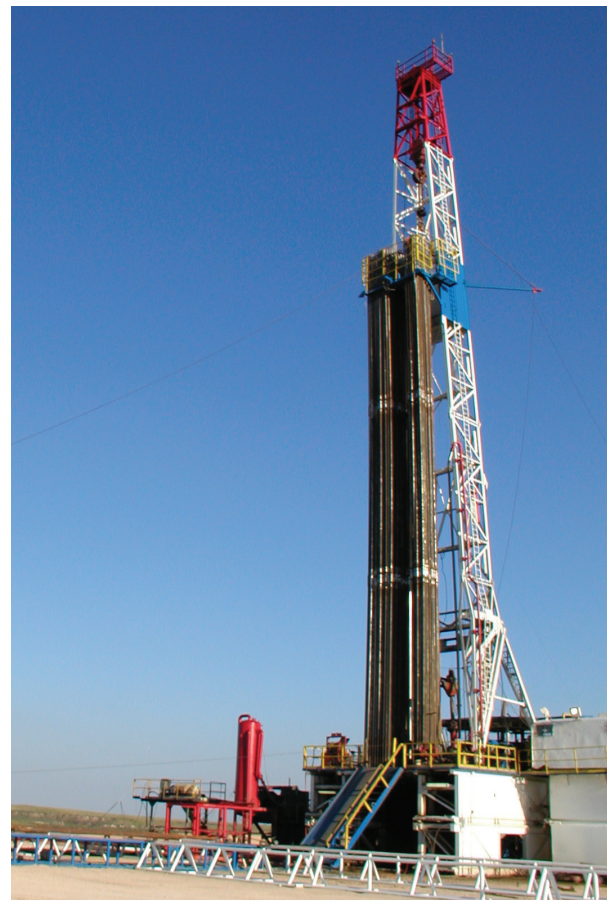
But it isn't just East Texas or Midland that has contributed to Texas' prolific oil production. The Levelland field was discovered in 1945, putting the Lubbock area on the map as a major oil producing center in Texas.

In 2011, some 3.5 million barrels of oil were produced in Lubbock County alone. Most of that production came from a rock formation called the Clear Fork, which is about a mile wide and extends all the way across the county from east to west, skirting the City of Lubbock between Loop 289 and the Preston Smith International Airport.

Texland Petroleum has been drilling for oil in the Clear Fork formation since the early 1980s. We operate 271 wells in Lubbock County, including more than 100 wells inside the city limits of Lubbock. Texland sees a bright future for continued oil production in Lubbock County, which will benefit residents in numerous ways. We have historically worked with the City to produce oil with the health and safety of Lubbock residents being our top priority.

However, in recent years, the proliferation of new production in unconventional formations – generally referred to as shale plays – have raised concerns in other parts of the nation that are less familiar with oil and gas production. Although many of the issues raised in shale plays are not applicable to conventional formations as in Lubbock, our community is reexamining existing ordinances to make sure its citizens are safe and the industry is operating responsibly.

At Texland, we applaud the review and are eager for our neighbors to become well informed about the industry. We want all residents to feel confident and secure in our operations. Our staff and their families live in and around Lubbock; safeguarding the environment is important to all of us. Please read about the issues and the facts here.





Texland operates more than 100 wells in the city limits.

What does that production mean for the residents of Lubbock like you?

Tax Revenues

For starters, millions of dollars in tax revenues that directly support the schools, hospitals, and other city services benefitting Lubbock residents. Over the last five years, Texland alone has paid more than \$6,600,000 in mineral property taxes paid to the Lubbock Central Appraisal District. Royalty owners make additional ad valorem tax payments estimated at 25% of Texland's payment, or an additional \$1,650,000.

Oil development by Texland has contributed over \$8 million in new tax revenue for parks, schools, and hospitals in Lubbock since 2009.

Over the last five years, Texland spent almost \$35 million with businesses with principal offices in Lubbock County.

Opportunities for Local Businesses

Texland uses local businesses for its operations in Lubbock and surrounding counties including our largest drilling vendor, Lubbock-based Norton Energy Drilling, LLC.

Employment Opportunities for Residents

Texland operates a field office in Levelland, employing 31 people including 11 Lubbock residents.

These are not minimum wage jobs— Texland paid \$2 million in total compensation to our field employees in 2012.

Additionally, we have paid nearly \$10 million in royalties to individuals and entities with a Lubbock address in the last five years.

Royalty Revenues

Last, but certainly not least, is the revenues paid to landowners in Lubbock county by way of royalties. Our largest royalty owner in Lubbock County is the City of Lubbock, which has received \$3,597,170 in royalties over the last five years.

Comparing Lubbock to the Barnett Shale

In any oil and gas development, the name of the game is extracting fluids stored in a rock formation. The key has historically been finding layers of rock and sand that have a high porosity - think of rocks filled with holes, like a sponge; and a high permeability - the measure of ease with which fluid can move through a particular rock.

In Lubbock County, production comes almost exclusively from the Clear Fork Formation, which is a dolomite rock layer lying approximately 5,300 feet below the surface. The formation has been developed for decades using hydraulic fracturing. The Clear Fork is a “conventional” reservoir—that is, it is a porous and permeable rock that has produced millions of barrels of oil.

By comparison, the Barnett Shale around Fort Worth holds incredible volumes of natural gas, but does not have the typical porosity and permeability that one would find in a conventional reservoir. These “unconventional” or “resource” plays have been made possible by new horizontal drilling and hydraulic fracturing techniques.

Permian Basin VS Barnett Shale



At left, you can see core samples from the Permian Basin. Note the abundance of naturally occurring holes and cracks in the rock allowing for the movement of fluid. The rock can be cracked easily with minimal amounts of water.



Compare this to a sample from an oil shale at right that has no visible natural pathway for fluids or gas to travel through. Pathways are created in shales by force with millions of gallons of water.



What is Hydraulic Fracturing?

Fracing is not a “drilling technique,” it is a technology that’s used to enhance the flow of hydrocarbons from a well once the drilling is done and the rig and derrick are removed from the scene. On average, the process takes three to five days to complete in a horizontal well, and one day in a vertical well. Once the fracturing operation is done, the well is considered “completed,” and is now ready to produce oil and natural gas for years.

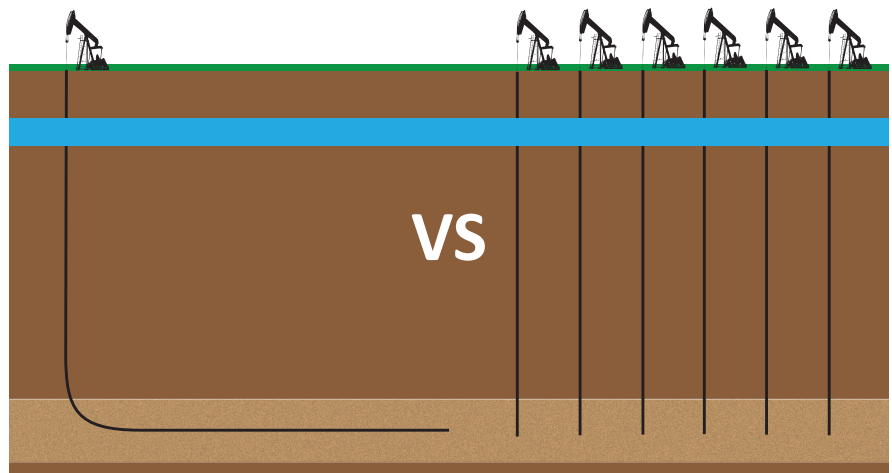
Hydraulic fracturing is the process of creating fissures, or fractures, in underground formations to allow oil and natural gas to flow. Water, sand and other additives are pumped under pressure into the formation to create fractures. The newly created fractures are “propped” open by the sand, which allows the oil and natural gas to flow into the wellbore and be collected at the surface.

The process is neither new nor unique to the oil and gas industry. Over the past 60 years, hydraulic fracturing has been used for a wide variety of purposes, from stimulating the flow from water wells to bringing geothermal wells into commercial viability. It has even been called on by EPA to serve as a remediation tool for cleaning up Superfund sites.

Nor is hydraulic fracturing new to Lubbock County. There are approximately 760 wells in the Clear Fork trend extending across the county, and Texland operates roughly half of them. Nearly all of them have been hydraulically fractured.

Horizontal Drilling

The biggest change in the last decade has been the introduction of horizontal drilling. Texland can now drill one horizontal well, complete several frac jobs from one surface location, and have the same or better results than 3-6 vertical wells would have in the same area. The size of each frac job is exactly the same as a vertical well, but the process is repeated in 8-10 different locations within the wellbore.



When leases permit horizontal drilling, we can reduce the amount of surface acreage used for pad sites because we can do from one location what would historically require up to six pad sites. We can also reduce the number of penetrations through groundwater reservoirs.

Water Usage and Groundwater Protection

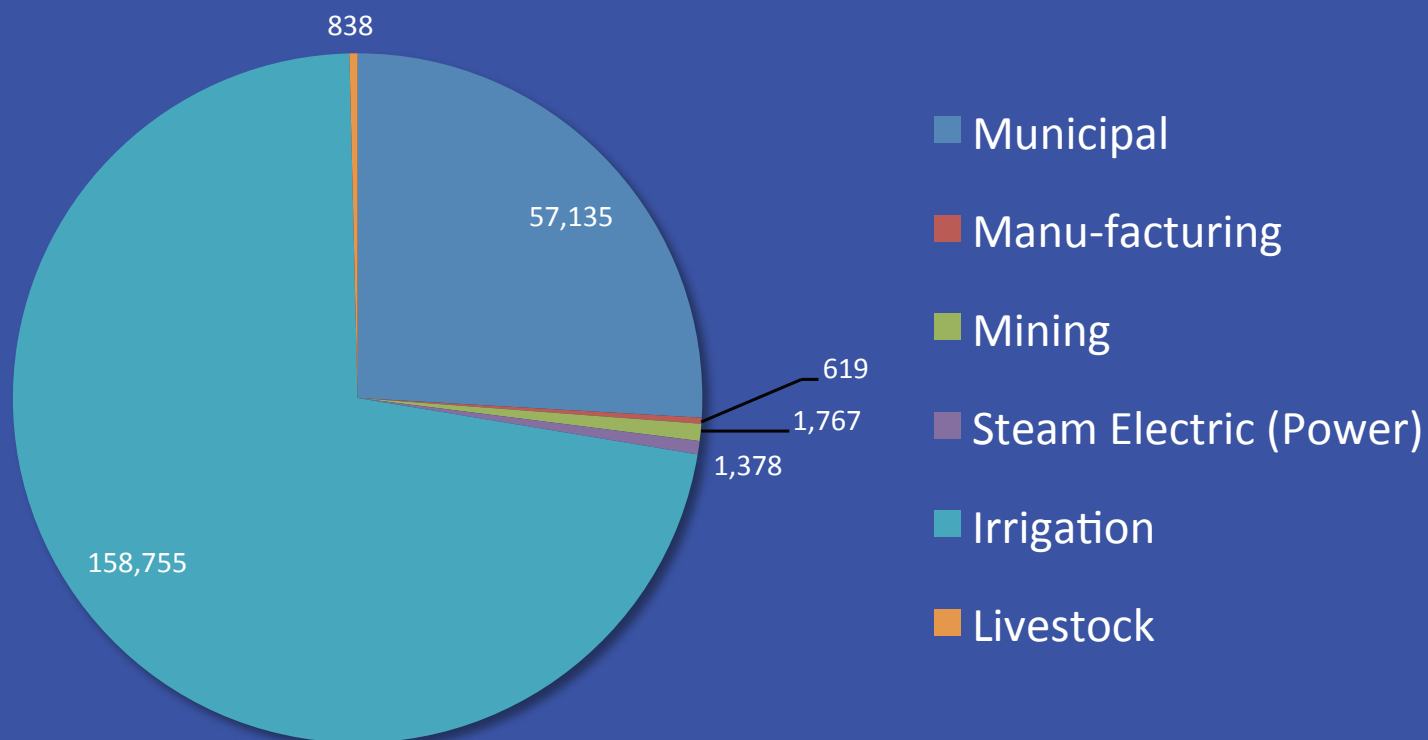
Water Usage Comparison

To extract gas from the Barnett Shale, companies had to create their own extensive network of fractures by forcing upwards of 2 million gallons of water per well into the shale to provide enough pressure to effectively “crack” it open.

By contrast, operators in Lubbock do not have to use nearly the volume of water to crack open pathways in rocks. For a horizontal Clear Fork well, Texland uses a total of 60,000 gallons of fluid in a typical frac job, being 40,000 gallons of produced crude oil and only 20,000 gallons of water. Hydraulic fracturing in the Clear Fork uses about 2% of the total fluids and 1% of the water used in the Barnett Shale.

A 2011 survey by the Texas Water Development Board shows that all “mining” related activities, including oil and gas drilling, constitute a total of 0.8% of the total water usage in Lubbock County. The largest water user by far is the agriculture industry, accounting for 72% of all surface water and groundwater usage in the county.

2011 Lubbock County Water Usage (in Acre Feet)





Groundwater Protection

As recently as last summer, U.S. Department of the Interior reported to Congress that **“we have not seen any impacts to groundwater as a result of hydraulic fracturing.”** In May 2011, EPA administrator Lisa Jackson told the U.S. Senate that she wasn’t aware “of any proven case where the fracing process itself affected water.” Letters from dozens of state environmental agencies – offices that have been regulating the fracturing process for decades — also confirm the safety of the technology.

How is this achieved?

Primarily because state regulatory programs place a great emphasis on protecting groundwater. Current well construction requirements consist of installing multiple layers of protective steel casing surrounded by cement that are specifically designed and installed to protect freshwater aquifers. These measures are completely effective in protecting drinking water aquifers from contamination.

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The Ground Water Protection Council issued a report in April 2009 stating that the potential for hydraulic fracturing in deep shale natural gas and oil wells to impact groundwater is extremely remote, as low as one in 200 million. More recently, the U. S. Department of Energy just completed a 12 month study in the Marcellus Shale. On July 19, 2013, the Associated Press reported as follows:

“Potentially dangerous substances stayed about a mile away from drinking water supplies.”

“Drilling fluids tagged with unique markers were injected more than 8,000 feet below the surface, but were not detected in a monitoring zone 3,000 feet higher. That means the potentially dangerous substances stayed about a mile away from drinking water supplies.

Eight new Marcellus Shale horizontal wells were monitored seismically and one was injected with four different man-made tracers at different stages of the fracking process, which involves setting off small explosions to break the rock apart. The scientists also monitored a separate series of older gas wells that are about 3,000 feet above the Marcellus to see if the fracking fluid reached up to them.”

Texland recently conducted a micro-seismic study of a hydraulic fracturing job in Andrews County. During a frac job on a horizontal well, seismic equipment was lowered in a nearby vertical well to “listen” for cracking rock. **The study showed that fractures stayed within 50 feet of the intended zone which is approximately one mile below the surface. Impermeable rock barriers above the formation prevent the transmission of fluid closer to the surface.**

Drilling Distance Setbacks & Well Inspectors

Drilling Distance Setbacks

The City of Lubbock's drilling ordinance provides a 300 foot buffer between any existing building and a drill site location. The resulting area excluded by this ordinance is a 6.5 acre circle surrounding any building within the city limits of Lubbock where drilling is not permitted.

The City Council is currently considering a 1,500 foot buffer from any building within the city limits and a drillsite location. The resulting area excluded under this proposal is a 162.3 acre circle surrounding any building within the city limits.

The City Council is also considering setbacks of 1,500 feet from property lines. This would limit drilling to one pad site in the center of a completely undeveloped property that is 3,000 feet x 3,000 feet, or at least 206 acres in the shape of a square. This provision would effectively prohibit drilling even from the middle of undeveloped farmlands as shown.

Other cities in the State of Texas have settled on setbacks ranging from none (Andrews), 150 feet (Odessa), 400 feet (Houston), and 500 feet (Midland). The current 300 feet buffer in the Lubbock ordinance would appear to fall within a reasonable range of current setbacks in place.

640 acres near Loop 289 at Guava Road.
There would be no permissible location to drill in this area under the proposed changes.

Well Inspections

The City Council is also considering employing a city inspector to monitor wells in the city limits. The current drilling ordinance already includes provisions allowing for the hiring of a city inspector, but the city has never hired one in the past.

Texland has conducted operations within the city limits for over 30 years without citizen complaint, including sensitive areas around Preston Smith International Airport and the Lubbock and Hillcrest Country Clubs. Each of Texland's wells in Lubbock County are inspected several times a year by a State inspector based out of Lubbock. Texland also conducts required tests and makes required reporting to the Railroad Commission annually with respect to the mechanical integrity of the wellbore and other matters. Employment of a city inspector appears to be redundant and likely ineffective use of city resources.



Closed Loop Systems—Issues and Solutions



Closed Loop Systems

The City Council is also considering requiring the use of “closed-loop systems” in drilling operations. Under current rules, Operators may use earthen pits, either above grade or below grade depending on various factors, to store fluids used in drilling. A closed-loop system uses above-ground steel tanks for the management of drilling fluids instead of the typically used below-grade tanks or pits. The State of Texas requires the use of plastic liners in drilling pits in some counties. *Of note, liners are not currently required in Lubbock County.*

Truck Traffic

One of the major downsides to closed loop drilling is the associated truck traffic. For a typical horizontal well, Texland uses water hauled by approximately 62 trucks for drilling and fracturing purposes. After Texland is finished drilling, the water evaporates from the lined pits, acids and other chemicals are neutralized, and the remaining mud and cuttings are buried under the surface.

When closed loop systems are used, Texland uses the same 62 trucks of water, but requires 40 additional trucks after drilling is complete to haul off water that would normally evaporate in a pit. In addition, 20 trucks are needed to haul off mud and cuttings that would normally be buried in place. The result is twice the traffic, twice the diesel truck emissions, and twice the wear and tear on local roads.

Cost Disadvantages of Closed Loop Systems

Another disadvantage of the closed-loop system is that it adds anywhere from \$250,000—\$350,000 to the cost of drilling a well. In the case of the wells Texland operates in Lubbock County, this would reflect a cost increase of up to 40% for each well drilled. This makes many projects in Lubbock cost-prohibitive. This affects not only Texland, but also

reduces revenues we pay to residents and local and county governments in royalties and ad valorem tax revenues.

For all the additional expense, closed loop systems do not solve the problem of disposing of cuttings. Instead, it requires the hauling of cuttings and other waste products to another location. This results in additional truck traffic and raises concerns regarding the availability of proper disposal locations in the county.

The real concern is not necessarily groundwater contamination, but rather topsoil contamination. There are many layers of caliche and other solid, impermeable rocks that protect groundwater sources from surface spills, but drilling fluids can contaminate the topsoil layer if they are not properly contained. In building its lined pits, Texland removes and stores the topsoil layer to create a large, sealed area that can handle a large volume of fluids, particularly in the event of a problem. The topsoil is returned upon the completion of operations.

In the event of failure of the closed loop system, drilling fluids fall directly onto unlined, bare topsoil, potentially damaging many acres of land in the event of a spill.

A suggested compromise would be permitting the use of pits, but requiring that all pits be lined. Texland already lines all pits in order to contain drilling fluids and also to reduce the amount of freshwater used. Other operators who do not currently line pits within the city limits will realize cost savings in water usage, mitigating the cost of lining pits.

Noise Level Concerns & Enforcement of EPA Standards

Noise Level Concerns

Another issue of concern for the City Council is that of noise control. Noise control has also been a prime concern for the federal Bureau of Land Management ("BLM"), albeit in a different context from urban drilling. The BLM is responsible for management of federal lands, primarily in the western United States. Their goals can be difficult to manage simultaneously, as they are tasked with both the preservation of the land and wildlife and the development of natural resources for the benefit of the citizens.

In 1999, the BLM commenced a long-term study of drilling noise associated with activity in rural Wyoming. The goal of the BLM was to investigate the effects drilling noise may have on wildlife habitat areas, and determine if there was a need to implement additional sound protection in such a rural setting.

For comparison, below is a chart showing the day/night average ambient sound levels for various environments, as determined by the EPA:

Location	Ldn (dBA)
Apartment located next to a highway	87
3/4 mile from a runway at a major airport	86
Downtown area with construction activity ongoing	79
Old urban residential area	59
Wooded residential area	52
Agricultural crop land	44
Rural residential area	39
Wilderness ambient	35

In their study, the BLM measured sound levels with respect to three different drilling rigs active in the Pinedale Anticline Project. The environmental impact statement gave a measured average noise at various distances from the pad site. At right are the measured noise levels at the closest distance to 300 feet, being the current setback distance under the Lubbock ordinance.

Pad Site	Avg. Noise (dBA)	Distance Measured
Ultra Site 1	57.2	346 feet
Ultra Site 2	62.2	337 feet
Shell Site 1	55.4	340 feet

The BLM found that the noise levels associated with drilling at a distance of roughly 350 feet fell closely in line with the average background noise in urban

residential neighborhoods, and were significantly less than the background noise associated with an urban downtown area.

With respect to drilling activities in the City of Lubbock, drilling has occurred almost exclusively along the Clear Fork formation, which runs in an east-west direction between Preston Smith International Airport and Loop 289. The area is primarily industrial and agricultural in nature, and the residential areas involved include areas around the Lubbock County Club and the Hillcrest Country Club. Texland has operated in these areas since the 1980s without receiving any noise complaints, and the reason appears to be evident from the BLM study results. That is, drilling with the current 300 foot setback results in noise levels comparable to that of the background ambient noise in a typical urban neighborhood. Issues regarding sound appear to be adequately handled by setbacks of 300 feet, without further setbacks required.

Enforcement of EPA Standards

One proposed amendment before the City Council calls for local enforcement of federal environmental regulations; specifically, a set of EPA standards issued April 17, 2012.

Texland currently complies with all state and federal emission rules with respect to its operations. EPA already has a timetable for enforcement of its policy phasing in by 2015. Additionally, EPA's website reports the following regarding the aim of the policy change: "The final rules are expected to yield a nearly 95 percent reduction in VOC emissions from more than 11,000 new hydraulically fractured gas wells each year. This significant reduction would be accomplished primarily through capturing natural gas that currently escapes into the air, and making that gas available for sale. The rules also will reduce air toxics, which are known or suspected of causing cancer and other serious health effects, and emissions of methane, a potent greenhouse gas."

The rule is primarily aimed at emissions from hydraulically fractured gas wells. Texland is not aware of one single well in Lubbock County that would be classified as a gas well. Rather, every well in the county

Reuse of Flowback Water, Chemical Disclosure, & Air Monitoring



is classified as an oil well.

The changes proposed by this rule are relevant in places like Fort Worth or Pittsburgh, PA, where the primary drilling target is natural gas production. In Lubbock, however, rules focused on gas production are simply not applicable. Further, the push for enforcement of EPA standards at a city level appears to be redundant with federal enforcement.

Reuse of Flowback Water

The City Council is also considering setting guidelines for the reuse or recycling of flowback water and produced water. This idea stems from water usage issues in places with unconventional plays, like Fort Worth, where each well uses 2-6 million gallons of water.

As mentioned previously, fracturing in the Lubbock area requires significantly less water than an unconventional play because of the nature of the rock formations involved. The water used in Lubbock is less than 1% of that used in the Barnett Shale.

Flowback and produced water is already “recycled” in a sense in the Lubbock area. In short, when a field is first discovered, natural gas in the rock produces pressure forcing oil to move toward lower pressure areas. When a well is drilled, the resulting “hole” in the rock becomes the lowest pressure area. The gas in place is sufficient to move oil toward the well for a while, but eventually the pressure becomes depleted as gas is produced from the well, and oil production levels drop.

To counter this, Texland and other operators engage in a secondary recovery process called waterflooding. Texland injects water in the producing formation to replace the lost gas. The water sweeps through the reservoir rock, dislodging oil molecules stuck in the formation and moving them once again toward the wellbore.

When wells are produced, the fluid is a mixture of oil and water. The fluid is placed in a separator, with the oil moving to tanks for a later sale and water moving into our waterflood system. While not “recycled” in the sense of using frac fluid twice, all of the fluids used by Texland in Lubbock County frac jobs are already repurposed and reused. This also eliminates our need to haul away produced water, resulting in reduced truck traffic in the area.

Disclosure of Chemicals

Texas has been a national leader in disclosure requirements regarding chemicals used in hydraulic fracturing. Under current regulations, Operators must report all chemicals used in a particular frac job with the FracFocus chemical disclosure registry for any well drilled after February 2012.

The state reporting requirements are sufficient to provide the residents and City Council with any information they may desire with respect to the chemicals used. Further, accurate advance reporting is not feasible because the composition of materials may change depending on conditions encountered in a particular well.

Given that EPA and the TCEQ have thoroughly analyzed this issue, created an intensive reporting requirement, and implemented a method of reporting, it seems logical that the City rely on the FracFocus structure rather than create its own.

The FracFocus reporting system in place is available at zero additional cost to the City, and is already open and available to any resident who has an interest and access to an internet connection.

Air Monitoring

Proposed amendments to the Ordinance also call for extensive monitoring of the air near pad sites after drilling operations. The EPA, acting through the TCEQ, already requires testing and reporting of emissions from pad sites and tank batteries. The regulations require Operators to engage third-party inspectors to test and report emissions to the TCEQ on an annual basis. If emissions cross a threshold amount, Operators are required to test more frequently. The process can be reviewed on the TCEQ website under “Air Quality Standard Permit for Oil and Gas Handling and Production Facilities.”

With the existing testing already managed by the TCEQ and the EPA, additional testing appears unnecessary. Further, the existing testing system includes an enforcement and remediation mechanism, which would require an extensive effort from the city to replicate.

Why Is This Important to YOU?

Development of oil and gas resources in Lubbock provides revenues and jobs that benefit all of Lubbock County and surrounding areas.

Proposed amendments to the Lubbock drilling ordinance would significantly hinder, if not prohibit, future drilling and development in the city. Many of the concerns are based on development in new “unconventional” gas plays, and those concerns are not applicable in Lubbock.

GET THE FACTS STAY INFORMED KEEP OUR ECONOMY STRONG



Please tell your city council and your community that you support the oil and gas industry. For more information visit our website at Texpetro.com/resources.

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